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APPENDIX E: Approaches for Conducting Alternatives Analysis

E.1 Approaches for Conducting Alternatives Analysis

This appendix provides instruction for conducting a quantitative alternatives analysis. OMB recommends this detailed approach when selecting an alternative to meet the needs and requirements of the organization. The seven steps that are necessary for conducting this level of analysis are highlighted below.

E.2 Step 1: Analyze the Current Environment and Requirements

The first step in conducting an alternatives analysis is to understand the current operating or status quo environment. This will provide a baseline for making comparisons between the existing and the proposed environment for each of the identified alternatives. Almost every investment, whether in facilities, personnel, technology, or knowledge affects numerous parts of the organization. Understanding how a potential investment impacts the current environment is critical in evaluating the return on investment and the expected short- and long-term values of the project.

E.3 Step 2: Identify Future Environment Requirements

After evaluating the current environment, the results of the current process should be compared to the stated objectives of the future environment. The outcome of this comparison enables the organization to determine its remaining requirements of the current environment and identify change opportunities. Once the opportunities for change have been identified, potential solutions must be developed. These solutions will become the investment alternatives that you should evaluate. By this point, the organization has analyzed its current environment, determined what needs to be improved, and can identify investment alternatives that will meet its future requirements.

E.4 Step 3: Identify Viable Alternatives

Once potential alternatives have been identified and the decision has been made to explore investing in a project, the alternatives are narrowed to a few viable options. The list of alternatives will include the status quo, as well as two other potential investments for comparing and selecting the appropriate alternative. To develop a short list of alternatives, each alternative is evaluated using nonfinancial, qualitative factors. Asking whether the organization can absorb the change and gauging the probable long-term success of the investment are critical before starting to calculate costs and benefits.

E.5 Step 4: Conduct Cost Analysis for the Status Quo and Each Alternative

The first step in conducting a cost estimate is to develop a cost element structure that categorizes the major cost components for the status quo and each alternative. This includes all costs that will be incurred in the development, production, and operations and maintenance phases of the projects. By first developing a cost estimate for the status quo, you can determine the resources required to operate and maintain the existing environment and determine the additional resources that will be required to develop, deploy, and maintain the

proposed alternatives.

E.6 Step 5: Conduct Benefit Analysis for Each Alternative

a. A business case analysis typically identifies both the quantitative and qualitative benefits of an alternative when evaluating total benefits. Quantitative benefits include the dollar saving investments to both the Federal Government and key stakeholders that may be obtained by implementing the proposed initiative. However, many benefits for certain public Government investments are qualitative in nature and do not lead directly to dollar savings. Improvements in customer service and employee morale are certainly recognized as benefits, but rarely can be included in the dollar-valued benefits stream or return on investment measures. Because many public goods are difficult to reliably quantify in dollar units, nonmonetary benefits are also vital to understand the total implementation outcome of the investment.

b. The following benefits should be addressed when evaluating total annual benefits for each alternative:

(1) Qualitative benefits.

(2) Cost savings.

(3) Cost avoidance.

(4) Stakeholder benefits.

(5) Nonmonetary quantitative benefits.

c. Each of these benefit categories is described in further detail in the following sections. Examples for calculating each of these benefits are also provided.

d. Qualitative Benefits ? This includes intangible benefits that are not dollar-quantifiable (e.g., employee morale, customer satisfaction).

e. Cost Savings ? This includes the savings that will result in a direct budget reduction for operations and maintenance costs between the status quo and proposed alternative environments (e.g., reduction in software/hardware maintenance costs). For example, if under the status quo system, NASA currently pays $1 million for annual hardware maintenance costs and will only pay $850,000 under the proposed alternative, then NASA will save $150,000 annually. This should be noted as a cost savings in your analysis. Similarly, if the proposed alternative will reduce the need for annual outsourcing by a certain amount, then this should be noted as well. The total operations and maintenance savings between the alternatives should be identified.

f. Cost Avoidance ? This includes the costs that will not be incurred under the proposed alternative that would otherwise have been incurred if the investment had not been made (e.g., avoid having to hire additional staff that would have been required under the status quo). For example, if under the alternative, NASA will not have to hire the additional five employees that would have been required to support increased workload under the status quo, the cost associated with the five employees should be calculated and included in the benefits analysis. The following section provides an example for conducting this cost avoidance analysis.

(1) Calculation: To determine the cost avoidance associated with these employees, you must first take the annual salary of a GS-13 employee, as required by the Office of Personnel Management, and multiply this salary by a burden/overhead rate to determine the fully-burdened cost of labor. This rate includes the cost of the following items: personnel benefits (i.e., Social Security, Federal Employees Group Life Insurance, Federal Employees Health Benefit, Federal Employees Retirement System, Civil Service Retirement System, and Thrift Savings Plan), overtime, cash awards, pay differentials, travel, ADP equipment, nonADP equipment, repairs and alterations to office space, etc. Typically, this burden/overhead rate is approximately 1.6 depending on the unique requirements of the Agency.

(2) The following equation can be used to determine the cost avoidance:

FTE?s Avoided x Employee?s Salary x Burden/Overhead Rate = Cost Avoidance

FTE?s Avoided	Employee?s Salary	Burden/Overhead Rate	Cost Avoidance =
5	$71,642	1.6	$573,136

Figure E1

g. Stakeholder Benefits ? This includes the savings that would be incurred by key stakeholders outside the organization (e.g., benefits to public citizens or private industry).

h. Nonmonetary Quantitative Benefits - This includes the performance improvements that will be achieved as a

result of implementing the initiative (e.g., decreased response time for customer service calls). For example, suppose one alternative will decrease the amount of time that will be required to address level one customer service calls at one of NASA?s contact Centers. You can illustrate improved performance levels by filling in the following table:

Performance Measure	Current Target	Future Target	Business Process Improvement
Average Customer Service Call	8 minutes	5.5 minutes	Improve customer service by reducing the amount of time to process a service call.
Number of Service Locations Covered by Help Desk Support	5 locations	10 locations	Increase help desk coverage to NASA employees.

Figure E2

i. Similar to preparing a cost estimate, the benefit analysis should include potential benefits over the same time period.

E.7 Evaluate Economic Measures Among the Alternatives

a. After calculating the costs and benefits for each alternative, comparisons can be made between the status quo and viable alternatives. In order to compare costs and benefits between alternatives, it is necessary to discount future costs and benefits to reflect the time value of money. The time value of money reflects the fact that money in hand today is more valuable than an identical amount of money received in the future. The following section provides an overview of what is discounting and how it should be applied when conducting cost/benefit analysis of alternatives.

b. What is discounting?

(1) Question: Why is current money more valuable than future money? Answer: Because you can do something with it now, e.g., the ability to buy food today is clearly more valuable than the ability to buy food a year from now.

(2) Benefits and costs are worth more if they are experienced sooner. We discount cost streams when we need to compare incurring costs at different times. For example, if cost is the only deciding factor, which investment should the organization invest in if the total cost is $500,000 over a five-year period?

CONSTANT $	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Project A						
Present Value (PV) Cost	$100,000	$100,000	$100,000	$100,000	$100,000	$500,000
Project B						
PV Cost					$500,000	$500,000
Project C						
PV Cost	$500,000					$500,000

Figure E3

(3) At first glance it may appear that the total investment is the same, since they each total $500,000. However, since the costs are incurred over different years, there are different cost implications for the organization.

c. The organization should invest in the project with the lowest discounted cost stream, given that the benefits for the alternatives are the same. In the example below, Project B has the lowest cost in terms of present value. For example, you need $500,000 today for Project C. Alternatively, you could put $440,810 in a bank today and receive the $500,000 you need in Year 5 for Project B. Economists contend that you are better off with Project B

because you can do something else with the $59,190 you did not put in the bank.

DISCOUNTED $	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Program Year	0	1	2	3	4	
Discount Factor	1.0000	0.9690	0.9389	0.9098	0.8816	
Project A						
PV Cost	$100,000	$96,899	$93,895	$90,983	$88,162	$469,939
Project B						
PV Cost					$440,810	$440,810
Project C						
PV Cost	$500,000					$500,000

Figure E4

d. OMB Circular A-94, Appendix C, provides the appropriate discount rates for conducting the alternatives analysis. Based on the ten-year real interest rates on Treasury notes and bonds, the real discount rate is 2.8%. Note: The real discount rate was recently updated in February 2004. While the following example is based on the assumption that the rate is 3.2%, please ensure that your analysis is based on the 2.8% rate.). The discount factor is equal to 1/(1+i)t, where ?i? is the interest rate and ?t? is the number of years from the date of initiation for the project.

E.7.1. How do you discount costs?

a. To illustrate this concept, a five-year estimate for three projects is provided in the following tables. By following each of the three steps, you will be able to discount both the costs and benefits for your project.

(1) Step 1 ? Determine the cost of each alternative in constant dollars.

CONSTANT $	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Project A (Status Quo)						
Investment Operations and Maintenance (O&M)	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$5,000,000
Total Cost	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$1,000,000	$5,000,000
Project B						
(Alternative 1)						
Investment	$500,000					$500,000
O&M	$1,000,000	$850,000	$850,000	$850,000	$850,000	$4,400,000
Total Cost	$1,500,000	$850,000	$850,000	$850,000	$850,000	$4,900,000
Project C						
(Alternative 2)						
Investment	$200,000		$100,000		$200,000	$500,000
O&M	1,000,000	1,100,000	1,100,000	$1,100,000	1,100,000	$5,400,000
Total Cost	$1,200,000	$1,100,000	$1,200,000	$1,100,000	$1,300,000	$5,900,000

Figure E5

(2) Step 2 ? Determine the benefits of each alternative in constant dollars.

(i) The assumptions for calculating cost savings, cost avoidance, and stakeholder benefits for Alternatives 1 and 2 are provided in the previous section entitled

Step 5: Conduct Benefit Analysis for Each Alternative.

CONSTANT $	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Project B (Alternative 1) Cost Savings	($500,000)	$150,000	$150,000	$150,000	$150,000	$100,000
Cost Avoidance		$573,136	$573,136	$573,136	$573,136	$2,292,544
Stakeholder Benefits		$68,000	$68,000	$68,000	$68,000	$272,000
Total Difference From A	($500,000)	$791,136	$791,136	$791,136	$791,136	$2,664,554
Project C (Alternative 2) Cost Savings	($200,000)	$(100,000)	$(100,000)	$(100,000)	($100,000)	$(600,000)
Cost Avoidance		$571,696	$571,696	$571,696	$571,696	$2,286,784
Stakeholder Benefits		$68,000	$68,000	$68,000	$68,000	$272,000
Total Difference From A	($200,000)	$539,696	$539,696	$539,696	$539,696	$1,958,784

Figure E6

(ii) The costs and benefits are then discounted by the appropriate discount factor to account for the time value of money. Each of the tables provides only a five-year estimate for illustrative purposes. The actual estimate should cover a ten-year period.

(3) Step 3 ? Discount the costs and benefits:

DISCOUNTED $	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Program Year	0	1	2	3	4	
Discount Factor	1.0000	0.9690	0.9389	0.9098	0.8816	
Project A (Status Quo)						
PV Investment						
PV O&M	$1,000,000	$968,992	$938,946	$909,831	$881,620	$4,699,389
PV Total Cost	$1,000,000	$968,992	$938,946	$909,831	$881,620	$4,699,389
PV Cost Savings						

PV Cost Avoidance						
PV Stakeholder Benefits						
PV Total Benefits						
Project B (Alternative 1)						
PV Investment	$500,000					$500,000
PV O&M	$1,000,000	$823,643	$798,104	$773,357	$749,377	$4,144,481
PV Total Cost	$1,500,000	$823,643	$798,104	$773,357	$749,377	$4,644,481
PV Cost Savings		$145,349	$140,842	$136,475	$132,243	$554,908
PV Cost Avoidance		$555,364	$538,144	$521,457	$505,288	$2,120,253
PV Stakeholder Benefits		$65,891	$63,848	$61,869	$59,950	$251,558
PV Total Benefits		$766,605	$742,834	$719,800	$697,481	$2,926,720
Project C (Alternative 2)						
PV Investment	$200,000		$93,895		$176,324	$ 470,219
PV O&M	$1,000,000	$1,065,891	1,032,841	$1,000,815	$969,782	$5,069,328
PV Total Cost	$1,200,000	$1,065,891	$1,126,735	$1,000,815	$1,146,105	$5,539,547
PV Cost Savings		$(96,899)	$(93,895)	$ (90,983)	$ (88,162)	$ (369,939)
PV Cost Avoidance		$553,969	$536,792	$520,147	$504,018	$2,114,926
PV Stakeholder Benefits		$65,891	$63,848	$61,869	$59,950	$251,558
PV Total Benefits		$522,961	$506,745	$491,032	$475,807	$1,996,546

Figure E7

(i) After the costs and benefits are discounted, the following three economic measures should be used to compare the economic feasibility of each of the alternative investments:

(4) Net Present Value (NPV) - OMB Circular A-94 states that the standard criterion for deciding whether a Government program can be justified on economic principles is net present value, the discounted monetized value of expected net benefits (i.e., benefits minus costs). Net present value is computed by assigning monetary values to benefits and costs, discounting future benefits and costs using an appropriate discount rate, and subtracting the sum total of discounted costs from the sum total of discounted benefits. Discounting benefits and costs transforms

gains and losses occurring in different time periods to a common unit of measurement. Programs with positive net present value increase social resources and are generally preferred. Programs with negative net present value should generally be avoided. Net present value can be calculated by the following equation:

(i) NPV = (PV O&M Savings Between Status Quo and Alternative + PV Cost Avoidance + PV Stakeholder Benefits ? PV Investment Costs).

PV (Annual Benefits)			**PV (Annual Costs)**	**Net Present Value (NPV)**
	Plus	Plus	Minus	Equals
PV O&M Savings Between Status Quo & Alternative	PV Cost Avoidance	PV Stakeholder Benefits	PV Investment Costs	
$554,908	$2,120,253	$251,558	$500,000	$2,426,720

Figure E8

(5) Return on Investment (ROI) ? The ROI measures the amount of savings generated for each dollar of investment for an alternative. In a desirable economic situation, the ROI is greater than one. If the ROI is equal to one, then there is no advantage in implementing the proposed environment. The higher the ROI, the greater the economic advantage to the organization. ROI is calculated by the following equation:

(i) ROI = PV Savings/PV Investment = (PV O&M Savings Between Status Quo and Alternative + PV Cost Avoidance + PV Stakeholder Benefits)/PV Investment Costs).

PV Savings =	The PV of any systems operations savings that may arise from the replacement of the status quo by the proposed alternative plus the present value of potential cost avoidance and stakeholder benefits.
PV Investment =	The PV of the initial investment for the proposed alternative (development cost plus implementation cost).

Figure E9

PV (Annual Benefits)			**PV (Annual Costs)**	**ROI**
	Plus	Plus	Divided By	Equals
PV O&M Savings Between Status Quo & Alternative	PV Cost Avoidance	PV Stakeholder Benefits	PV Investment Costs	
$554,908	$2,120,253	$251,558	$500,000	5.85

Figure E10

(ii) To illustrate this measure, the ROI has been calculated for Alternative 1. The same process should be used to compute the other alternatives? ROIs.

Alternative 1 ROI = ($554,908 + $2,120,253 + $251,558)/ $500,000 = 5.85

(6) Discounted Payback Period (DPP) ? DPP is defined as the number of years it takes to recover the investment costs from the discounted net cash flows. The advantage of DPP is that it gives consideration to a project?s cost of capital. DPP is measured in time, where NPV is measured in dollars. DPP occurs the first year in which cumulative NPV is positive.

(i) To illustrate this measure, the NPV for Alternative 1 has been calculated over a five-year period. In addition, the

cumulative NPV has also been calculated.

DISCOUNTED $	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Alternative 1 Annual NPV	$ (500,000)	$766,605	$742,834	$719,800	$697,481	$2,426,720
Alternative 1 Cumulative NPV	$ (500,000)	$266,605	$1,009,439	$1,729,239	$2,426,720	$2,426,720

Figure E11

(i) From this analysis, you can see that the cumulative NPV for the project is positive for the first time in Year 2. Therefore, the discounted payback period is approximately two years.

(7) Compare and Recommend an Alternative

(i) Once all of the costs and benefits of the alternatives are understood, a comparison of alternatives may be conducted. Comparisons must be made in two areas: the financial impact and the strategic value impact per dollar invested. ROI and NPV metrics represent the return realized by an organization in financial terms. The Discounted Payback Period illustrates the number of years it takes to recover the investment costs from the discounted net cash flows. These metrics allow an organization to understand how they will save money or avoid certain costs through implementation of a particular initiative.

E.8 Summary Analysis

	Status Quo	Alternative 1 Enhancement to Status Quo	Alternative 2 New Systems
Feasibility/Performance Score	16	25	22
Discounted Cost	$4.7 M	$ 4.6 M	$ 5.5M
NPV	-$ 4.7 M	$2.4 M	$1.5 M
ROI	Do not need to calculate.	5.85	4.25
Payback Period	Do not need to calculate.	Approximately 2 years.	Approximately 2 years.

Figure E12

(1) Based on the key measures, Alternative 1 should be selected due to its higher NPV and ROI values and performance score. However, when comparing and recommending an alternative, it is imperative to also demonstrate that this alternative also best supports the mission of the organization.

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